

**Abstract**

Methods and apparatus are provided for plasma doping of a workpiece. The plasma doping apparatus includes a housing defining a plasma doping chamber, a platen for supporting a workpiece in the plasma doping chamber, an anode spaced from the platen in the plasma doping chamber, a process gas source coupled to the plasma doping chamber, a vacuum vessel enclosing the plasma doping chamber and defining an outer chamber, a primary vacuum pump connected to the vacuum vessel, a pulse source for applying pulses to the anode, and a controller. The controller establishes a controlled plasma doping environment in the plasma doping chamber in a first mode, typically a plasma doping mode, and establishes a gas connection between the plasma doping chamber and the outer chamber in a second mode, typically a vacuum pumping and wafer exchange mode.